International Journal of Agricultural
Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 5, Issue 5, Oct 2015, 89-94

GENETIC CORRELATION AND PATH-COEFFICIENT ANALYSIS OF YIELD AND ITSCOMPONENTS IN GROUNDNUT (*ARACHIS HYPOGAEA* L.) GENOTYPES

VINUTHA. D. N[1], ARUNA. Y. R[2], JAGADEESH. B. N[3] & SAVITRAMMA D. L[4]

[1,2]Department of Genetics and Plant Breeding, University of Agricultural Sciences,
Bangalore, Karnataka, India

[3]Genetics and Plant Breeding, DLAP, University of Agricultural Sciences,
Bangalore, Karnataka, India

ABSTRACT

Increasing of oil yield one of the most important goals in groundnut (*Arachis hypogaea* L.) breeding programs In this study, six F_2 crosses of groundnut genotypes were evaluated to investigate the interrelationship among the yield attributing traits and physiological traits .The phenotypic correlation coefficients revealed that high association of pod and kernel yield with other yield attributing traits like number of pods plant^{-1} and sound mature kernel. The physiological traits of SCMR and SLA were significant negatively correlated with each other in all crosses except in cross GKVK- 5 × GPBD-4. Phenotypic path coefficient analysis further delineated that the direct effect for pod yield plant^{-1} was mainly accelerated by kernel yield plant^{-1} in all six crosses, while other characters had very low direct effects on pod yield and thus kernel yield is the important trait for enhancing pod yield in groundnut. This association indicates that these yield related parameters can be used as preliminary screening tools for selecting high yielding genotypes for the next generation.

KEYWORDS: Groundnut, Phenotypic Correlation Coefficient, Phenotypic Path Coefficient

INTRODUCTION

Groundnut is an allotetraploid (2n=4x= 40) with a basic chromosome number of x=10 (Stalker 1992). It is highly self-pollinated crop and has cleistogamous flowers. Groundnut is an unpredictable crop due to its underground pods development. Nut yield is not only polygenically controlled, but also influenced by its component characters (Alam *et al.* 1985). For improvement of yield in groundnut direct selection is often misleading. Understanding the relationships among yield and yield components is of paramount importance for making the best use of these relationships in selection. Correlation analysis is a biometrical technique to find out the nature and degree of association between various traits indicating yield, while path analysis splits the correlation coefficient into direct and indirect effect so as to measure the relative contribution of each variable towards yield (Saeidi *et al.* 2011). Therefore information derived from the correlation coefficients can be augmented by partitioning correlations into direct and indirect effects by path coefficient analysis.

MATERIALS AND METHODS

The present investigation was carried out at the Postgraduate students experimental field, K-Block, Department of Genetics and Plant Breeding, GKVK, University of Agricultural Sciences, Bangalore. The material for the present study consisted of seven genotypes of groundnut *viz*., ICG12370, NRCG12473, NRCG12274, GKVK-8B, GKVK-5, GPBD-4

and Chinthamani-2. F_2 plants derived from each of the six crosses *viz.*, ICGV 12370 × NRCG12473, ICGV 12370 × NRCG12274, GKVK-8B × GPBD-4, GKVK-5 × GPBD-4, GKVK-8B × Chinthamani-2 and GKVK-5 × Chinthamani-2 and their parents along with check TMV-2 were planted 20 m^2 plots with a spacing of 0.4 × 0.3 m during *kharif 2012*. A total of 100-300 plants were available in each of the six crosses for recording observations. The details of method adopted for recording observations are days to first flowering, plant height (cm), primary branches plant^{-1}, pods plant^{-}1, pod yield plant^{-1} (g), kernel yield plant^{-1} (g), Shelling percentage**,** Sound Mature Kernel (SMK %), Specific leaf area (SLA) was measured by taking second or third fully expanded leaf of the main branch was collected and the leaf area was measured using leaf area meter. Then the leaves were kept in an oven at 70°C for 3 days. The dry weight of the leaf was accurately measured using a sensitive balance. SLA was computed using the formula Leaf area (cm^2)/ Leaf weight (g) and expressed as cm^2/g and SPAD Chlorophyll Meter Reading (SCMR) taken by a device has been developed by Minolta company, New Jersey USA (SPAD-502) which measures the light attenuation at 430nm (the peak wavelength for chlorophyll a and chlorophyll b) and at 750 nm (near infra red) with no transmittance. The unitless value measured by the chlorophyll meter is termed as SCMR (SPAD Chlorophyll Meter Reading), which provides information on the relative amount of leaf chlorophyll. The SPAD meter (Soil Plant Analytical Development) is a simple hand held instrument, which operates with DC power of three Volts. The second or third leaf from the apex was selected to record the SCMR. Selected leaf of groundnut was clamped avoiding the mid rib region into the sensor head of SPAD meter. A gentle stroke was given to record the SPAD reading and the average of such four strokes per leaflet was considered. Since groundnut is a tetra-foliate leaf, SCMR was recorded in all the four leaflets and the average value was recorded. The SCMR was recorded under normal sunlight between 9.00 am to 4.00 pm.

Statistical Analysis

The data were subjected to statistical analysis using Windostat software. Phenotypic correlation coefficient was estimated computer software program following Sunder Raj *et al.* (1972). Path coefficient analysis was carried out using phenotypic correlation values to ascertain the direct and indirect effect of the yield components on yield as suggested by Wright (1921).

RESULTS AND DISCUSSIONS

Correlation Analysis

The results of the Correlation Coefficient among the traits studied in F_2 generation are shown in Table 1. The results of correlation analysis showed that among six F_2 crosses ICGV12370 × NRCG12274 showed high degree of negative significant association between days to flowering with number of pods plant^{-1} and pod yield plant^{-1}. However, all the six crosses had no positive association between early flowering with pod yield and its related traits. This indicates early maturing genotypes are low yielders. Similar findings were reported by earlier workers *viz.*, Makhan *et al.*(2003); Korat *et al*. (2010) and Meta and Monpara (2010).

Plant height (cm) was found to have high degree of positive significant association with number of pods plant^{-1}, kernel yield plant^{-1}(g) and pod yield plant^{-1}(g) in cross *viz.*,ICGV12370×NRCG12473, GKVK-8B × GPBD-4 , GKVK-8B×Chintamani-2 and GKVK-5 × GPBD-4. Whereas, crosses ICGV12370× NRCG12274 and GKVK-5 ×Chintamani-2 had negative association. However all the six crosses had no positive association with sound mature kernels and shelling percentage. These characters can be considered as criteria for selection for higher yield, as these were mutually and directly associated with pod yield. The high direct effect of pods per plant was appeared to be the main factor for its strong positive

correlation with pod yield. Hence, a direct selection for this trait would be effective. These results are in accordance with the earlier findings of Dolma *et al*. (2010) and John *et al*. (2012) reported significant positive correlation of pod yield plant^{-1} with plant height, mature pods plant^{-1} and kernel yield plant^{-1}.

Cross ICGV12370× NRCG12274 exhibited high positive significant association between number of branches plant^{-1} with number of pods plant^{-1}, kernel yield plant^{-1} as well as pod yield plant^{-1}. However, this trait as no positive significant association with sound mature kernels and shelling percentage. Suggesting that selection can be practiced for genotypes with more number of primary branches which indirectly leads to selection of high yielding types in both the generations. These results are in accordance with earlier workers like Venkataravana *et al.*(2000) and John *et al.* (2012) reported pod yield had significant positive correlation with plant height and branches plant^{-1}.

Among physiological trait SCMR, cross ICGV12370×NRCG12274 exhibited significant positive association with kernel yield plant^{-1}, pod yield plant^{-1} and sound mature kernels.

SLA was found to have high degree of positive significant association with sound mature kernels, shelling percentage and kernel yield plant^{-} in cross GKVK-8B × Chintamani-2. High degree of negative significant association with number of pods plant^{-1} and pod yield plant^{-1} was observed in GKVK-5 × GPBD-4.Venkateswaralu *et al.* (2007) reported both additive and non additive gene action in the expression of SCMR, SLA and yield related traits *viz*., shelling per cent, pod yield and kernel yield per plant.

SCMR and SLA were significant negatively correlated with each other in all crosses except in cross GKVK- 5 × GPBD- 4 in F_2 generation.

Similar reports reported by Sah *et al.* (2000); Nagda *et al.* (2001);Makhan *et al.* (2003); Kavani *et al.* (2004) confirmed the association between number of pods per plant, pod yield and kernel yield per plant. Meta and Monpara (2010) also reported same results in groundnut. This association indicates that these yield related parameters can be used as preliminary screening tools for selecting high yielding genotypes with high Water use efficiency for the next generation.

Path Co-Efficient Analysis: Was carried out to reveal the relationship between yield and yield components through direct and indirect effects. The results of the path co-efficient analysis among the traits studied in F_2 generation are shown in Table 2.

High positive direct effect for pod yield plant^{-1} was highly manifested by kernel yields plant^{-1}in six crosses. These results are in accordance with the reports of Moinuddin (1997) for pod yield; Gomes *et al.* (2005); Dolma *et al*., (2010) for the kernel yield plant^{-1}in groundnut. Hence selection for pod yield would contribute greatly towards enhancing kernel yield plant^{-1} in F_2 generation. Meta and Monpara (2010) reported kernel yield plant^{-1} contributed major share to pod yield plant^{-1}, indirectly through other traits.

REFERENCES

1. Alam, M.S., Rahman, A. R. M. S. and Khair, A. B. M. A., 1985, Genetic variability and character association in groundnut (*Arachis hypogaea* L.). *Bangladesh, Agric. J*., **10**(4): 9-16.
2. Dolma,T., Reddi Sekhar, M and Raja reddy., 2010, Genetic variability, correlation and path analysis for yield, its components and late leaf spot resistance in groundnut (*Arachis hypogaea* L.). *Oilseeds Res.j*., **27** (2) : 154- 157.

3. Gomes, R. L. and Lopes, A., 2005, Correlation and path analysis in Peanut. *Crop Breeding and Appl. Biotech*., **5**(1): 105-110.
4. John, K., Raghava ,R. P., Haripraad , R. K., Sudhakar , P and Eswar, N. P., 2012, Variability, Correlation and Path coefficient analysis for morpho-physiological traits in groundnut (*Arachis hypogaea* L.) *Plant Archives.*, **12**(1): 315-325.
5. Kavani, R. H., Golakia, P. R., Makne, V. G. and Madaria, R. B., 2004, Genetic variation and trait associations in Valencia groundnut (*Arachis hypogaea* L.). *In:* Proceedings of National symposium on enhancing productivity of groundnut for sustaining food and nutritional security, NRCG, Junagadh, pp.no 27.
6. Korat, V. P., Pithia, M. S., Savaliya, J. J., Pansuriya, A. G., and Sodavadiya, P. R., 2010, Studies on characters association and path analysis for seed yield and its components in groundnut (*Arachis hypogaea* L.). *Legume Res*., **33**(3): 211-216.
7. Makhan Lal, Roy, D. and Ojha, O. P, 2003, Genetic variability and selection response for root and other characters in groundnut (*Arachis hypogaea* L.). *Legume Res*., **26**(2): 128- 130.
8. Meta, H.R., and Monpara.B. A (2010). Genetic variation and trait relationships in summer groundnut, *Arachis hypogaea* L. *Oilseeds Res.,* **27** (1) : 8-11.
9. Moinuddin, H. H., 1997, Evaluation of Genotype x Environment interaction in Groundnut (*Arachis hypogaea L.)* genotypes. *M.Sc. (Agri.)* thesis submitted to University of Agricultural Sciences, Bangalore.
10. Nagda, A. K., Dashora, A. and Jain, D. K., 2001, Character association in parents and hybrids of groundnut (*Arachis hypogaea L.). Crop Res.,* **22**(3): 463-468.
11. Saeidi-Nia, M ., H Emami, R Honarnejad and M Esfahani ., 2011, *American-Eurasian J. Agric. & Environ. Sci*., **10**(6), 972-977.
12. Sah, J. N., Ramesh Kumar and Varshney, S. K., 2000, Correlation and path analysis in mutant cultures of groundnut. *J. Oilseeds Res.,* **17**(1): 23- 28.
13. Stalker, H. T., 1992, Utilization *Arachis* germplasm resources. *In* S. N. Nigam (ed.) Groundnut-A Global Perspective. *Proc. Int. Workshop*, ICRISAT. 281-295.
14. Sunder Raj, N., Nagaraju, S., Venkataramu, M. N. and Jaganath, M. K., 1972, *Design and analysis of field experiments*, University of Agricultural Sciences., Bangalore.
15. Venkataravana, P., Sheriff, R. A., Kulkarni, R. S., Shankaranarayana, V. and Fathima P. S., 2000, Correlation and path analysis in groundnut (*Arachis hypogaea L.). Mysore J. Agric Sci.,* **34**(4): 321 325.
16. Venkateswarlu, O., Reddy, K. R., Reddy, P. V., Vasanthi, R. P., Reddy, K. H. P and Reddy, N.P.E., 2007, Identification of superior donor parents for drought tolerance and yield through combining ability analysis in groundnut. *Legume Res.,* **30**(2):128-132.
17. Wright, S., 1921, Correlation and causation. *J. Agric. Res.,* **20**:557-585.

APPENDICES

Table 1: Estimates of Phenotypic Correlation Coefficients of Growth and Physiological Traits with Pod Yield and Its Component Traits in F_2 Generation for Six Crosses of Groundnut

Characters	Crosses	Pods Plant^{-1}	Pod Yield Plant^{-1} (G)	Kernel Yield Plant^{-1} (G)	Shelling Percentage (%)	Sound Mature Kernels (%)
Days to first flowering	ICGV 12370 × NRCG 12473	-0.1438**	-0.0907	-0.1007	-0.0877	-0.1184*
	ICGV 12370 × NRCG 12274	-0.2651**	-0.2269*	-0.2108*	0.0009	0.0478
	GKVK- 8B × GPBD-4	-0.0622	0.0041	-0.015	-0.0427	0.0103
	GKVK-5 × GPBD-4	-0.1617*	-0.0995	-0.0563	0.1009	0.0256
	GKVK- 8B × Chinthamani -2	-0.0541	-0.0502	-0.0311	0.0323	-0.0034
	GKVK -5 × Chinthamani-2	0.0915	0.0177	-0.0467	-0.0251	-0.0183
Plant height (cm)	ICGV 12370 × NRCG 12473	0.3038**	0.3036**	0.2571**	-0.075	-0.1248*
	ICGV 12370 × NRCG 12274	0.025	-0.0036	-0.0296	-0.1298	-0.1302
	GKVK- 8B × GPBD-4	0.2543**	0.2167**	0.1911**	-0.0419	-0.0283
	GKVK-5 × GPBD-4	0.3547**	0.2766**	0.1849**	-0.2561**	-0.2024**
	GKVK- 8B × Chinthamani -2	0.1759*	0.2193**	0.3132**	0.0266	-0.006
	GKVK -5 × Chinthamani-2	-0.0743	-0.1679	-0.1526	-0.1677	-0.2216*
Branches plant^{-1}	ICGV 12370 × NRCG 12473	0.2955**	0.183**	0.1513**	-0.0407	0.0074
	ICGV 12370 × NRCG 12274	0.4787**	0.4647**	0.4479**	0.1445	0.1592
	GKVK- 8B × GPBD-4	0.2378**	0.2396**	0.1906**	-0.0524	-0.0093
	GKVK-5 × GPBD-4	0.2968**	0.2861**	0.259**	-0.0108	0.0062
	GKVK- 8B × Chinthamani -2	0.4209**	0.1527	0.2889**	-0.0295	-0.0222
	GKVK -5 × Chinthamani-2	0.2925**	0.2059	0.2087	0.0498	-0.0076
SCMR (65 day)	ICGV 12370 × NRCG 12473	-0.0538	-0.0179	-0.019	-0.0213	-0.0139
	ICGV 12370 × NRCG 12274	0.1199	0.2285*	0.2495*	0.1806	0.2334*
	GKVK- 8B × GPBD-4	-0.0718	0.0146	0.033	-0.0167	0.1118
	GKVK-5 × GPBD-4	0.0148	0.0865	0.0931	0.0722	0.1249
	GKVK- 8B × Chinthamani -2	0.0202	-0.0261	0.1011	0.1942*	0.1484
	GKVK -5 × Chinthamani-2	0.1053	0.0713	0.1348	0.2073	0.1157
SLA (cm^2/g) (65 day)	ICGV 12370 × NRCG 12473	0.0084	0.0379	0.0072	-0.0282	0.0205
	ICGV 12370 × NRCG 12274	-0.0885	-0.0618	-0.0571	-0.0151	0.0038
	GKVK- 8B × GPBD-4	-0.0887	0.1291	0.138	0.0667	0.2004**
	GKVK-5 × GPBD-4	-0.2677**	-0.1843**	-0.1056	0.1611*	0.1437*
	GKVK- 8B × Chinthamani -2	0.0355	0.041	0.1856*	0.2151**	0.2868**
	GKVK -5 × Chinthamani-2	-0.0748	0.1481	0.1728	0.0589	0.2617*

Table 2: Phenotypic Path Co-Efficient Analysis Indicating Direct Effects on Pod Yield in F_2 Generation of the Six Crosses in Groundnut

Sl. No	Character	ICGV 12370 × NRCG 12473		ICGV 12370 × NRCG 12274		GKVK8B × GPBD 4		GKVK-5 × GPBD 4		GKVK 8B × Chintamani -2		GKVK 5 × Chintamani -2	
		Direct effect	r	Direct Effect	r	Direct Effect	r	Direct Effect	r	Direct Effect	r	Direct Effect	r
1	Days to first flowering	-	-	0.003	-0.227*	-	-	-	-	-	-	-	-
2	Plant height (cm)	0.024	0.304**	-	-	0.009	0.217**	-0.008	0.277**	-0.014	0.219**	-	-
3	Branches per plant	-0.005	0.183**	0.008	0.465**	0.037	0.240**	-0.012	0.286**	-0.116	0.153*	-	-
4	Pods per plant	0.133	0.829**	0.049	0.823**	0.117	0.674**	0.095	0.662**	-0.025	0.490**	-0.044	0.778**
5	Kernel yield per plant (g)	0.886	0.965**	0.916	0.965**	0.885	0.949**	0.940	0.952**	0.637	0.659**	0.882	0.877**
6	Shelling percentage (%)	-0.178	0.163**	-0.215	0.283**	-	-	-0.225	0.267**	-	-	-	-
7	Sound mature kernels (%)	0.042	0.239**	0.067	0.460**	-0.063	0.398**	0.056	0.322**	0.414	0.299**	-	-
8	SCMR (65 day)	-	-	0.004	0.229*	-	-	-	-	-	-	-	-
9	SLA (cm^2/g) (65 day)	-	-	-	-	-	-	-	-	-	-	-	-
	Residual effect	0.1653		0.1672		0.2523		0.1675		0.5876		0.3034	